

# MONOGRAPH OF SCHOENOCAULON<sup>1</sup>

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## INTRODUCTION

Interest in a monographic treatment of the genus *Schoenocaulon*, a member of the Liliaceae, tribe Veratreae, was aroused by the state of taxonomic confusion into which it had fallen. Though the first plants of this genus were discovered more than a hundred years ago and more have been constantly collected since then, no monographic study has as yet been made of *Schoenocaulon*. From time to time new species were described which, in some cases, only increased the confusion. The problem resolved itself into a delimitation of the genus, a determination of the true generic name, the study of the morphological features which distinguish the species, and the geographical distribution of the genus as a whole and of the several species.

## HISTORY OF THE GENUS

The genus *Schoenocaulon* was first proposed by Asa Gray in 1837. It was based on *Helonias dubia* Michx. Michaux gave us the first description of the plant in 1803.<sup>2</sup> He had his doubts as to the genus when he designated some plants from Georgia and Florida as *Helonias dubia*. Willdenow,<sup>3</sup> Pursh,<sup>4</sup> Nuttall,<sup>5</sup> and others considered the species as doubtful *Helonias*. Later Gray made the segregation but called the plant *Schoenocaulon gracile*.<sup>6</sup>

Schiede and Deppe collected some plants on the eastern side of the Mexican Sierras. These were recorded by Schlechtendal and Chamisso as *Veratrum*, and in 1831 they proposed *Veratrum officinale* as a new species.<sup>7</sup> Hartweg found some more in the neighbor-

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<sup>2</sup> Michx. Fl. Bor. Am. 1: 213. 1803.

<sup>3</sup> Willd. in Ges. Naturf. Freunde Berlin, Mag. 2: 29. 1808.

<sup>4</sup> Pursh, Fl. Am. Sept. 1: 244. 1814.

<sup>5</sup> Nuttall, Gen. N. Am. Pl. 1: 234. 1818.

<sup>6</sup> Gray, Ann. Lyc. N. Y. 4: 127. 1837.

<sup>7</sup> Schlecht. & Cham. in Linnaea 6: 45. 1831.

hood of Vera Cruz and sent them to the Royal Horticultural Society of London. Lindley had no doubt that these were the same as Schiede and Deppe's plants. However, he saw they were not of the genus *Veratrum* and proposed the name *Asagraea officinalis*.<sup>8</sup> No sooner had Dr. Gray seen the illustration and description of the plant than he realized that it belonged to his genus *Schoenocaulon*. Examination of Schiede and Deppe's specimen confirmed his opinion.<sup>9</sup> When in 1836 [1837] Brandt and Ratzeburg treated *Veratrum officinale*<sup>10</sup> they inserted a footnote calling this plant *Sabadilla officinarum*, but they used *Sabadilla* as a subgeneric name in their main description.

The next species appeared in literature in 1838 when Schlechten-dal described an Ehrenberg specimen as *Veratrum caricifolium*.<sup>11</sup> Six years later Schlectendal tried to correct his generic designation and change the name to *Sabadilla caricifolia*.<sup>12</sup> But he was too late, for Gray in 1840 had examined the same specimens and rightfully called them *Schoenocaulon caricifolium*.<sup>13</sup>

*Schoenocaulon Drummondii* was described by Gray in 1840, from a plant in Drummond's Texas collection.<sup>14</sup> The species *Schoenocaulon tenuifolium* was first called *Veratrum tenuifolium* by Martens and Galeotti in 1842,<sup>15</sup> and *Asagraea tenuifolia* by Kunth a year later.<sup>16</sup> Robinson and Greenman made the proper combination in 1895.<sup>17</sup>

Lindheimer collected Texas plants in the spring of 1846 and sent them to Scheele who called no. 543 *Schoenocaulon texanum*.<sup>18</sup> From this description Gray mistook the plant for his *S. Drummondii* and reduced *S. texanum* to synonymy.<sup>19</sup> These two species were continually confused until 1916, when Pennell pointed out their several points of difference.<sup>20</sup>

*Schoenocaulon Coulteri* is the name given by Baker in 1879 to a

<sup>8</sup> Lindl. in Edwards' Bot. Reg. 2: t.33. 1839.

<sup>9</sup> Gray in Hook. & Arn. Bot. Beechey's Voy. 388. 1840.

<sup>10</sup> Brandt & Ratzeb. in Hayne, Darstel. v. Beschreib. d. Arzneig. 13: t.27. 1836. [1837].

<sup>11</sup> Schlecht. in Ind. Sem. Hort. Hal. 8. 1838.

<sup>12</sup> Schlecht. in Linnaea 18: 444. 1844.

<sup>13</sup> Gray in Hook. & Arn. Bot. Beechey's Voy. p. 388. 1840.

<sup>14</sup> Gray in Hook. & Arn. Bot. Beechey's Voy. 388. 1840.

<sup>15</sup> Mart. & Gal. in Acad. Roy. Brux. Bul. 9<sup>2</sup>: 380. 1842.

<sup>16</sup> Kunth, Enum. Pl. 4: 700. 1843.

<sup>17</sup> Robins. & Greenm. in Am. Jour. Sci., III, 50: 168. 1895.

<sup>18</sup> Scheele in Linnaea 25: 262. 1852.

<sup>19</sup> Holographic notes of Dr. A. Gray, in Libr. Mo. Bot. Gard.

<sup>20</sup> Pennell in Bull. Torrey Bot. Club 43: 408. 1916.

plant which Coulter found near Zimapan, Mexico.<sup>21</sup> Hemsley<sup>22</sup> and Kuntze<sup>23</sup> have the only other references in literature to this plant. Greenman described the next species, *S. Pringlei*, in 1897<sup>24</sup>; and *S. calcicola*, *S. Ghiesbreghtii* and *S. jaliscense* in 1907.<sup>25</sup> The most recent description is that of *S. megarhiza* by Marcus E. Jones in 1912.<sup>26</sup>

*Schoenocaulon intermedium* has had a career of confusion ever since its description by Baker in 1879.<sup>27</sup> Various plants have been placed in and taken out of the species. The original description was too general and the type specimens so poor that no definite idea of the real species could be formed. Evidence seems to point to the correctness of Hemsley's statement that "probably *S. intermedium* may not be a distinct species"<sup>28</sup> and should be reduced to synonymy under *S. texanum*.

#### MORPHOLOGY

The bulb of *Schoenocaulon* is generally egg-shaped and covered with either dark, thin, dry scales, as in *S. Drummondii* and *S. dubium*, or, as is more common, by a tangle of fibers. The fibers are the fibro-vascular bundles which persist after the mesophyll of the first leaf-bases has decomposed. In young plants these fibers are not thickly coated over the bulb and around the base of the leaves, but in plants several years old they show specific characters in the density, color and texture. Some species, for example *S. jaliscense*, have fine and rather soft fibers, while others, as *S. comatum*, are characterized by coarse and stiff fibers forming mats which resemble hanks of horsehair.

The grass-like leaves are all basal and afford specific characters as to length and breadth only when the average can be taken from a number of full-grown plants. The intergradation between a short leaf of a long-leaf species and an unusually long leaf of a short-leaf species makes leaf characters quite unsatisfactory for classification. As to number of veins in a leaf, it has been found impossible to use the character of venation with any degree of satisfaction.

<sup>21</sup> Baker in Jour. Linn. Soc. Bot. 17: 477. 1879.

<sup>22</sup> Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. 3: 383. 1885.

<sup>23</sup> Kuntze, Rev. Gen. Pl. 2: 713. 1891.

<sup>24</sup> Greenm. in Proc. Am. Acad. 32: 295. 1897.

<sup>25</sup> Greenm. in Proc. Am. Acad. 43: 19-20. 1907.

<sup>26</sup> Jones, Contr. West. Bot. 14: 29. 1912.

<sup>27</sup> Baker in Jour. Linn. Soc. Bot. 17: 477. 1879.

<sup>28</sup> Hemsley in Salvin & Godman, Biol. Cent.-Am. Bot. 3: 382. 1885.

Extreme cases of narrowness or breadth, as in *S. tenue* and *S. officinale* respectively, coupled with other features, may be of value in determining some of the species.

The scape is always naked, straight, and terete above. Usually the base is somewhat angled because of the pressure exerted on it in the bulb.

Some of the most valuable diagnostic features are to be found in the inflorescence, particularly its length and its diameter at anthesis. Other points to be noted are the disposition and spacing of the flowers on the axis, whether evenly or irregularly placed, whether crowded or distant from each other. In some species, as *S. regulare*, the flowers are all uniform in position and mature simultaneously. Other species, as *S. texanum* or *S. officinale*, have the lowermost flowers fruiting before those at the tip of the spike shed their pollen.

The six perianth segments are, with the exception of *S. Conzattii*, *S. Ghiesbreghtii*, *S. Pringlei*, and *S. tenuifolium*, about 2-3 mm. in length. *Schoenocaulon tenuifolium* is the only species with broadly ovate perianth-segments. All the other species have either ligulate or narrowly ovate segments. It is the margins of the segment which affords the most valuable character for specific determination. *Schoenocaulon Drummondii*, *S. tenuifolium* and *S. yucatanense* are erose-margined; *S. comatum*, *S. dubium*, and *S. officinale* are entire-margined; the majority of the species have a single hyaline tooth projecting from the sides of the segment near the base; others, such as *S. Ghiesbreghtii*, have two teeth on each margin. *Schoenocaulon Pringlei* is subscarious-margined and *S. caricifolium* is subdentate-margined. In all species, except *S. officinale*, the nectary gland is too inconstant and inconspicuous a character to be of much value.

The hypogynous stamens are six in number with large, reniform, single-celled anthers. In most species the filaments are twice the length of the perianth, while in *S. megarhiza*, *S. obtusum*, and *S. Pringlei* they scarcely project at all, and *S. yucatanense* has filaments three times as long as the perianth.

The mature fruit of most of the species is ovoid and somewhat inflated. *Schoenocaulon macrocarpum* has a capsule which is more linear than oval; that of *S. caricifolium* and *S. tenuifolium* shows marked inflation. The former has a regular oval shape, whereas the latter is obovate.

The seeds, if mature and obtained in sufficient abundance, may perhaps furnish added traits for determination of the species.

## ECONOMIC IMPORTANCE

The entire plant is poisonous, particularly the seeds, which are without odor but have an acrid burning taste. The medicinal virtue of the seed is due to the alkaloid veratrine. Tinctures, extracts, and powders were once made from the seeds and used for rheumatism, paralysis, cardiac conditions, dropsy, and as a taenicide. Because it is such a drastic purgative and productive of such severe vomiting and internal bleeding it has been discarded as a remedy in internal medicine. Several deaths from its employment have been recorded. Its use nowadays is restricted to veterinary medicine or for destroying body lice and other vermin. Specimens received recently from H. S. Gentry bear the following notation concerning the plants he collected in Sinaloa, Mexico: "Roots employed for killing maggots in wounds; powdered and applied or decocted as a wash."

## RELATED GENERA

*Schoenocaulon* has been confused with several genera, particularly *Helonias*, *Veratrum*, *Tofieldia*, and *Zygadenus*. The following tabulation will furnish some salient morphological features useful in distinguishing *Schoenocaulon* from related genera.

- |                        |   |
|------------------------|---|
| <i>Schoenocaulon</i> : | Base of plant a fibrous-tunicate bulb; leaves basal, narrow; scape simple; flowers disposed in a spike or dense raceme; perianth-segments glandular or eglanular.       |
| <i>Helonias</i> :      | Base of plant a short tuberous root-stock; leaves basal, broad and fleshy; scape simple; flowers disposed in a raceme; perianth-segments not glandular.                 |
| <i>Veratrum</i> :      | Base of plant a fibrous-tunicate bulb; leaves cauline, broad; inflorescence a dense terminal panicle; perianth-segments not clawed, eglanular.                          |
| <i>Tofieldia</i> :     | Base of plant a short creeping rhizome; leaves 2-ranked, equitant; flowers disposed in a dense raceme or spike; perianth-segments not clawed.                           |
| <i>Zygadenus</i> :     | Base of plant a rhizome or a tunicated bulb; leaves basal, linear; scape branched; flowers disposed in an open panicle; perianth-segments glandular, distinctly clawed. |

## GEOGRAPHICAL DISTRIBUTION

*Schoenocaulon* has been found in the southernmost parts of the United States, in Mexico, Central America, and in two states of South America.

*Schoenocaulon dubium* is the only Floridan species. *S. Drummondii* and *S. texanum* are found in Texas and northern Mexico. The latter species grows as far north as the southeastern counties of New Mexico. The widest distributed species is *S. officinale*, having been collected in Mexico, throughout Central America, and in parts of Venezuela and Peru.

The paucity of specimens makes an adequate distribution picture of the genus *Schoenocaulon* impossible. Those states of Mexico and Central America which have been more extensively botanized have contributed a greater number of species. Gaps between localities where such species as *S. comatum* and *S. regulare* are found indicate the need of more field work and collecting.

## COMMON NAMES

*Schoenocaulon* has a number of common names, such as: Green Lily (Texas), Feather-shank (Florida), Sabadilla, Sabadille, Cebadilla, Cevadille, Cevadilha, Matu Curros, Semen Sabadillae, Sabadillsamen, Capuziner Samen, Laeusekraut, Mexicanischer Laeusesamen and several others.

## ABBREVIATIONS

Sincere appreciation is expressed to all those institutions whose cooperation and facilities have made this work possible. The herbaria cited in this monograph are indicated by the following abbreviations:

- CA—California Academy of Sciences.
- D—Dudley Herbarium of Stanford University.
- F—Field Museum of Natural History.
- G—Gray Herbarium of Harvard University.
- M—Missouri Botanical Garden.
- P—Pomona College.
- PA—Academy of Natural Sciences of Philadelphia.
- UC—University of California, Berkeley.
- US—United States National Herbarium.

## TAXONOMY

**Schoenocaulon** Gray in Ann. Lyc. N. Y. **4**: 127. 1837; Endl. Gen. Pl. 1357. 1840; Meisn. Pl. Vasc. Gen. **1**: 405. 1836-43; Kunth, Enum. Pl.

**4**: 185. 1843; Chapm. Fl. South. U. S., 490. 1860; Baker in Jour. Linn. Soc. Bot. **17**: 476. 1879; Benth. & Hook. f. Gen. Pl. **3**: 836. 1880; Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 383. 1885; Engl. & Prantl, Nat. Pflanzenfam. **II**. 5: 23. 1888; Small, Fl. Southeast. U. S. 250. 1903, and ed. 2, 1913; Small, Man. Southeast. Fl., 277. 1933.

*Veratrum* Schlecht. & Cham. in Linnaea **6**: 45. 1831, not L.

*Helonias* Don in Edinb. N. Phil. Jour. 234. 1832, not L.

*Sabadilla*<sup>29</sup> Brandt [Brandt & Ratzeburg] in Hayne, Arzneig. **13**: t. 27. 1836 [1837], as subgenus; Schlecht. in Linnaea **18**: 444. 1844, as genus; Kuntze, Rev. Gen. Pl. **2**: 713. 1891; Dalla-Torre & Harms, Gen. Siph. 60. 1900–1907; Engl. & Prantl. Nat. Pflanzenfam. ed. 2, **15a**: 261. 1930.

*Skoinolon* Raf. Fl. Tellur. **4**: 27. 1836, nomen prius.

*Asagraea* Lindl. in Edwards' Bot. Reg. **2**: pl. 33. 1839; Hook. & Arn. Bot. Beechey's Voy. 388. 1840; Kunth, Enum. Pl. **4**: 184. 1843; A. Rich. in Orb. Dict. **2**: 199. 1845; Spach in Hist. Nat. Veg. Phan. **12**: 245. 1846, not *Asagraea* Baill. in Adansonia **9**: 233. 1870.

#### DESCRIPTION OF THE GENUS

Herbaceous perennials; bulb oblong to ovoid; basal portion of the plant surrounded by a cylindrical covering of brownish-black to black scales and fibers, the remnants of the first bulb-scales and outer leaves; leaves all basal, grass-like, long and narrow, attenuate into a hair-like tip, flat, coarsely and strongly nerved, firm in texture, glabrous on both sides, slightly or not at all glaucous, margins serrulate; scape erect, simple, naked, glabrous, glaucous and terete above, purplish and angled below; spike virgate, many-flowered, bracteate, terminal portion bearing sterile flowers; bracts small, solitary, partly clasping the axis, broad-triangular or deltoid, rounded or acuminate-tipped, thin, scarious, dull hyaline, erose-margined; flowers perfect, at first crowded, later more or less scattered, regular, small, erect, sessile or on short stout pedicels, base

<sup>29</sup> Brandt and Ratzeburg, in 1836 [1837], in Hayne's 'Darstellung und Beschreibung der Arzneigewächse,' recognized *Veratrum officinale* Schlecht. as a valid name and described and illustrated this plant in detail. *Sabadilla* was definitely included as a subgenus of *Veratrum*. In a footnote they suggested the possible binomial *Sabadilla officinarum*. This name, however, is accompanied by the following statement. "Es schien uns daher besser, für jetzt ein Subgenus! unter dem Namen *Sabadilla* vorschlagen, um jene auffallenden Eigenthümlichkeiten anzudeuten." Since *Sabadilla* was here placed in the rank of subgenus it cannot, according to the International Rules of Botanical Nomenclature, supersede the generic name of *Schoenocaulon* Gray which was validly published in 1837.

broadly bell-shaped to hemispherical, pale green to yellowish-white; perianth-segments 6, hypogynous, cyclic, subequal, sessile, free or scarcely united at the base, somewhat spreading, persistent, faintly 3-5-nerved, leathery to scarious, obtuse, oblong to narrowly linear, entire, subentire, 1-2-dentate on either margin, or erose, often hyaline-margined, glandular or eglandular; stamens 6, hypogynous, subequal, inserted at the base of the perianth-segments, persistent, erect; filaments filiform, yellow to purplish-red, awl-shaped, at first short, later elongating, recurved; anthers large, versatile, yellow, reniform before dehiscence, later clypeolate or peltate, unilocular, extrorse; ovary ovoid, constricted at the base, superior, free from the perianth and stamen-cycle, tricarpellary; ovules 6-8 in each cell, biseriate, axillary, ascending, anatropous; styles 3, distinct, divergent, slightly recurved, short, tapering to the apex; stigma terminal, simple, minute; capsule ovoid to oblong, acuminate, chartaceous, glaucous, persistent, 3-celled, septicidally dehiscent, pedicels when present stout, recurved or ascending; seed ovate to slender-oblong, nearly terete, often curved, slightly winged at the apex, coat corrugated, dark brown and shiny, 1-5 superposed and compressed in each cell, albumen firm, embryo minute, near the hilum.

Type species: **Schoenocaulon dubium** (Michx.) Small, Fl. Southeast. U.S., 250. 1903 (*S. gracile* Gray in Ann. Lyc. N. Y. 4: 127. 1837).

#### KEY TO THE SPECIES

- A. Perianth-segments ligulate, margins not toothed; nectaries prominent.....
- ..... 14. *S. officinale*
- AA. Perianth-segments ligulate to ovate, margins with or without teeth; nectaries absent or not prominent..... B
- B. Inflorescence 15-20 mm. in diameter.....
- ..... C
- C. Perianth-segments ovate, 3 mm. broad..... 18. *S. tenuifolium*
- CC. Perianth-segments ligulate, 1 mm. broad..... D
- D. Perianth-segments with erose margins..... 6. *S. Drummondii*
- DD. Perianth-segments with entire or with few-toothed margins..... E
- E. Flowers crowded on the spike..... 8. *S. Ghiesbreghtii*
- EE. Flowers loosely disposed on the spike..... 4. *S. Conzattii*
- BB. Inflorescence 5-15 mm. in diameter..... C
- C. Perianth-segments with erose margins..... 20. *S. yucatanense*
- CC. Perianth-segments not erose-margined..... D
- D. Perianth-segments obscurely or not at all dentate, not scarious-margined... E
- E. Bulb covered with coarse stiff fibers; scape 15-30 cm. long..... F
- F. Scape 15-17 cm. long; capsules strongly inflated.... 2. *S. caricifolium*
- FF. Scape 18-30 cm. long; capsules not strongly inflated.... 3. *S. comatum*
- EE. Bulb covered with scales or fine fibers; scape 30 cm. or more long..... F
- F. Spike narrow, 5-8 mm. in diameter..... 7. *S. dubium*
- FF. Spike wider, 10-15 mm. in diameter..... 19. *S. texanum*
- DD. Perianth-segments distinctly dentate or scarious-margined..... E

- E. Leaves narrow, 0.5–2.5 mm. wide.....F
- F. Flowers crowded on the axis; capsules 10–12 mm. long..15. *S. Pringlei*
- FF. Flowers distantly disposed on the axis; capsules 8–10 mm. long....
- .....17. *S. tenui*
- G. Spikes 4–10 cm. long, 10 mm. in diameter.....17. *S. tenui*
- GG. Spikes 1.5–6 cm. long, 13–14 mm. in diameter.....5. *S. Coulteri*
- EE. Leaves broader, 2–8 mm. wide.....F
- F. Scape 85–150 cm. long.....G
- G. Spike 30–40 cm. long.....9. *S. jaliscense*
- GG. Spike 14–23 cm. long.....12. *S. Mortonii*
- FF. Scape 25–75 cm. long.....G
- G. Flowers all uniform in size and disposition on the axis.....H
- H. Filaments scarcely projecting beyond the perianth; capsules numerous, 5–7 mm. in diameter, closely imbricated and appressed to the axis.....13. *S. obtusum*
- HH. Filaments twice the length of the perianth-segments; capsules few, 4–5 mm. in diameter, small and distantly placed on the axis, not imbricated or appressed to the axis.....16. *S. regulare*
- GG. Flowers of different sizes and irregularly disposed on the axis.....H
- H. Fruit reflexed.....1. *S. calcicola*
- HH. Fruit not reflexed.....I
- I. Leaf 3–6 mm. broad; scape 40–60 cm. long; flowers subsessile.....11. *S. megarhiza*
- II. Leaf 2–3 mm. broad; scape 30–45 cm. long; flowers pedicelled.....10. *S. macrocarpum*

**1. *Schoenocaulon calcicola* Greenm. in Proc. Am. Acad. **43**: 19. 1907.**

Bulb ovoid, 1.5–3 cm. in diameter; basal portion of the plant covered with coarse black fibers extending to a height of 5–14 cm.; leaves thin, 3–10 dm. long, 2–4 mm. broad; scape 5.5–7.5 dm. long, slender, somewhat flexuous, purplish toward the base; spike 8–23 cm. long, 8–10 mm. in diameter, the flowers loosely and irregularly disposed on the axis, small, sessile, short-pedicelled; perianth-segments slender, 2.5–3 mm. long, bearing a single tooth on each margin; filaments twice the length of the perianth; capsule oblong-lanceolate, 8–10 mm. long, 5 mm. in diameter, reflexed; 2–3 seeds in each cell.

MEXICO—OAXACA: Las Sedas, calcareous banks, alt. 1830 m., 19 July 1897, *Pringle* 6740 (G, M, NY, PA, UC, US); hillsides, alt. 1830 m., 1 Aug. 1894, *Pringle* 5754 (G TYPE, US).

**2. *Schoenocaulon caricifolium* (Schlecht.) Gray in Hook. & Arn. Bot. Beechey's Voy. 388. 1840; Wats. in Proc. Am. Acad. **14**: 281. 1879, excluding *Coulter* 1568; Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 383. 1885 in part; Greenm. in Proc. Am. Acad. **43**: 19. 1907, excluding *Conzatti & Gonzalez* 323.**

*Veratrum caricifolium* Schlecht. in Ind. Sem. Hort. Hal. 8. 1838; in Linnaea Litt. Ber. 13: 100. 1839.

*Asagaea caricifolia* Kunth, Enum. Pl. 4: 666. 1843.

*Sabadilla caricifolia* Schlecht. in Linnaea 18: 444. 1844.

Bulb 15–25 mm. in diameter; base of the plant covered for 7–17 cm. with dark brown, stiff fibers; leaves narrow, flexuous, 3–3.5 dm. long, 1–3 mm. broad; scape stout, short, 15–17 cm. long; spike short and narrow, 4–6 cm. long, 10 mm. in diameter; flowers small and crowded on the axis; perianth-segments obscurely subdentate, oblanceolate, 3 mm. long; capsule broadly ovate, inflated, 15 mm. long, 10 mm. in diameter, compacted into a fruiting spike 3.5 cm. in diameter; seed 6–7 mm. long, 1–3 in each cell.

MEXICO—COAHUILA: "mountain borders," near Saltillo, 25 June 1848, *Gregg* 214 (G, M). HIDALGO: near los Baños de Atotonilco el Grande, calcareous mountains, Oct. and Dec., *Ehrenberg* (G TYPE, NY, P). OAXACA: near City of Oaxaca, 16–21 June 1899, *Rose & Hough* 4972 (US); Cerro Verde, Aug. 1908, *Purpus* 4389 (UC).

### 3. *Schoenocaulon comatum* Brinker, n. sp.<sup>30</sup>

Bulb ovoid, 1.5–3 cm. in diameter; base of the plant covered for 8–26 cm. with a thick cylinder of blackish, coarse, stiff fibers; leaves longer than the scape, straight, as much as 6 dm. long and 2–4 mm. broad; scape 18–30 cm. long, erect, purplish toward the base; spike loosely flowered, attenuate, 3.5–15 cm. long, 7–12 mm. in diameter at anthesis; flowers small, subsessile; perianth-segments entire-margined, 2–3 mm. long, ligulate; filaments thin, twice as long as the perianth; mature capsule ovate-oblong, chartaceous, erect, inflated, 10–13 mm. long, 6–7 mm. in diameter; pedicel of the fruit 3–4 mm. long; 2–3 seeds in each cell.

MEXICO—SAN LUIS POTOSI: Valley of San Louis Potosi, San Miguelito Mts., coll. of 1876–1878, *Schaffner* 536 (PA, G, NY); without definite locality, *Schaffner* 228 (CA, NY TYPE, P, PA, UC, US); region of San Luis Potosi, alt. 1830–2440 m., coll. of 1878, *Parry & Palmer* 882 (G, M, PA, US); Chareas, July-Aug. 1934, *Whiting* 523 (D, NY, US). PUEBLA: Cerro de Mazize, moist soil, July 1907, *Purpus* 2731 (UC); vicinity of San Luis Tultitlanapa, June 1908, *Purpus* 2731 (G, NY, M, US). OAXACA: Canada de San Gabriel, Etla, alt. 300 m., 8 Aug. 1897, *Conzatti & Gonzalez* 323 (G).

<sup>30</sup> *Schoenocaulon comatum* sp. nov. Bulbus ovoideus, 1.5–3 cm. diametro; caudice cylindro, 7–26 cm. longo, fibris nigrescentibus crassis rigidis dense obtecto; foliis scapo longioribus, rectis, usque ad 6 dm. longis, 2–4 mm. latis; scapo 18–30 cm. longo, erecto, basin versus purpureo; spica laxiflora, attenuata, 3.5–15 cm. longa, anthesi 7–12 mm. diametro; floribus parvis, subsessilibus; perianthii segmentis integris, 2–3 mm. longis, ligulatis; filamentis tenuibus, perianthio duplo longioribus; capsulis maturis ovato-oblongis, chartaceis, erectis, inflatis, 10–13 mm. longis, 6–7 mm. diametro; pedicello fructus 3–4 mm. longo; seminibus in loculo 2–3.

**4. Schoenocaulon Conzattii** Brinker, n. sp.<sup>31</sup>

Bulb ovoid, 1.5–2 cm. in diameter; base of the plant covered for 7–23 cm. with a dense sheath of dark brown, coarse fibers; leaves 6–11 dm. long, 4–7 mm. broad; scape 5–7 dm. long; spike 10–25 cm. long, 15–17 mm. in diameter; mature flowers loosely disposed, erect, shortly pedicelled; perianth-segments with a single tooth on each margin, linear-lanceolate, 3.5–4 mm. long; filaments twice or three times as long as the perianth; immature capsule 8 mm. long, 4 mm. wide, imbricated, pedicel arched and 3–4 mm. long; 4–5 seeds in each cell.

MEXICO—HIDALGO: Sierra de Pachuca, alt. 2981 m., 1 Sept. 1906, *Pringle* 13841 (G, US). STATE OF MEXICO: Temascaltepec, Rincon del Carmen, woods, alt. 1340 m., 23 Nov. 1932, *Hinton* 2690 (NY); Nanchititla, oak woods, 8 Oct. 1933, *Hinton* 4970 (G, M, NY). OAXACA: Cerro de San Felipe, alt. 2000 m., 29 Aug. 1897, *Conzatti & Gonzalez*, 449 (G, US TYPE). PUEBLA: Boca del Monte, moist grassy soil, June 1907, *Purpus* 2490 (UC).

**5. Schoenocaulon Coulteri** Baker in Jour. Linn. Soc. Bot. **17**: 477. 1879; Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 382. 1885; Coulter in Contr. U.S. Nat. Herb. **2**: 440. 1894 (Bot. West. Texas), as to name only.

*Sabadilla Coulteri* Kuntze, Rev. Gen. Pl. **2**: 713. 1891.

The only specimen available for examination comprises fragments of leaf tips and parts of flowering stalks. The spikes measure 1.5–6 cm. in length and 13–14 mm. in diameter; the flowers are erect, somewhat loosely set on the axis of the inflorescence; perianth-segments leathery, with a single tooth on each margin, 3 mm. long; filaments reflexed, twice the length of the perianth, anthers small, globular.

MEXICO—HIDALGO: near Zimapan, *Coulter* 1569 (G ISOTYPE).

**6. Schoenocaulon Drummondii** Gray in Hook. & Arn. Bot. Beechey's Voy. 388. 1840; Torrey in Bot. U.S. & Mex. Bound. Surv. **2**: 222. 1859, in part, excluding Pl. Lindh.; Wats. in Proc. Am. Acad. **14**: 281. 1879; Baker in Jour. Linn. Soc. Bot. **17**: 477. 1879, in part, excluding *Lindheimer* 543, 711; Wats. in Proc. Am. Acad. **18**: 166.

<sup>31</sup> *Schoenocaulon Conzattii* sp. nov. Bulbus ovoides, 1.5–2 cm. diametro; caule fibris densis atrobrunneis crassis ad 7–23 cm. dense obtecto; foliis 6–11 dm. longis, 4–7 mm. latis; scapo 5–7 dm. longo; spica 10–25 cm. longa, 15–17 mm. diametro; floribus maturis laxe dispositis, erectis, breviter pedicellatis; perianthii segmentis utraque margine dente unico, linear-lanceolatis, 3.5–4 mm. longis; filamentis duplo vel triplo perianthio longioribus; capsulis immaturis 8 mm. longis, 4 mm. latis, imbricatis, pedicello arcuato, 3–4 mm. longo; seminibus in cellulo 4–5.

1883, in part, as to *Palmer* 1322 only; Hemsley in Salvin & Godman, Biol. Cent.-Am. Bot. 3: 382. 1885 in part, as to name only; Small, Fl. Southeast. U.S. 250. 1903.

*Schoenocaulon aletroides* Gray in Hook. & Arn. Bot. Beechey's Voy. 388. 1840.

*Sabadilla Drummondii* Kuntze, Rev. Gen. Pl. 2: 713. 1891.

Bulb ovoid, 2–3.5 cm. in diameter; base of the plant covered with thin scales and few fibers for 5–12 cm.; leaves 2–5 dm. long, 1.5–5 mm. broad; scape 2.5–6 dm. long; spike dense, 3–20 cm. long, 15–20 mm. in diameter; flowers subsessile; perianth-segments oblong-ovate, 3 mm. long, 1 mm. broad, nearly membranaceous, with broad scarious, erose margins; filaments stout, subclavate-filiform, much dilated above, 5–7 mm. long; flowering in autumn.

Distribution: southwestern United States and Mexico.

UNITED STATES:

TEXAS—BEE CO.:  $\frac{1}{2}$  mi. s. of Tuleta, 21 Sept. 1936, *Cory* 20644 (G). BEXAR CO.: San Antonio, Oct. 1837, *Riddell* (US). COLORADO CO.: 3 mi. e. of Alleyton, sandy soil, 22 Sept. 1913, *Pennell* 5557 (NY). DE WITT CO.: roadside near Yorktown, 6 Oct. 1857, *Schott* (NY). DUVAL CO.: 25.6 mi. n.w. of San Diego, 9 Oct. 1935, *Cory* 16146 (G). GOLIAD CO.: near Goliad, open prairie, 7 Oct. 1926, *Williams* 91 (PA). GUADALUPE CO.: Seguin, limestone soil, 22 Aug. 1903, *Groth* 202 (CA, G, NY, US). SAN PATRICIO CO.: s. of Mathis, 20 Oct. 1927, *Rose & Russell* 24160 (US). WILSON CO.: Sutherland Springs, Aug. 1879, *Palmer* 1322 (G). WITHOUT DEFINITE LOCALITY: coll. of 1880, *Palmer* 1322 (US); Valley of the Rio Grande, below Donana, *Parry*, *Bigelow*, *Wright & Schott* 1482 (US); *Drummond I* 284 (G); *Drummond III* 284 (NY TYPE); 1 Oct. 1935, *Parks* (G); 1840, *Riddell* 52 (NY); 188—, *Schlottmann* (US).

MEXICO—SAN LUIS POTOSI: San Dieguito, 13–16 June 1904, *Palmer* 119 (G, M, NY, US); Tamazunchale, Cerro de S. Francisco, 11 May 1891, *Manry* 6257 (G).

7. ***Schoenocaulon dubium* (Michx.) Small**, Flora Southeast. U.S. 250. 1903, and ed. 2, 1913; Small, Man. Southeast. Fl. 277. 1933.

*Helonias dubia* Michx., Fl. Bor. Am. 1: 213. 1803; Willd. in Ges. Naturf. Freunde Berlin Mag. 2: 29. 1808; Poiret in Lamarck, Encycl. Meth. Bot. Suppl. 3: 28. 1813; Pursh, Fl. Am. Sept. 1: 244. 1814; Nutt. Gen. N. Am. Pl. 1: 234. 1818; Roem. & Schult. Syst. 7: 1565. 1830.

*Schoenocaulon gracile* Gray in Ann. Lyc. N.Y. 4: 127. 1837, and in Hook. & Arn. Bot. Beechey's Voy. 388. 1840; Kunth, Enum. Pl. 4: 185. 1843; Chapman, Fl. South. U.S. 490. 1860; Wats. in Proc. Am. Acad. 14: 280. 1879; Baker in Jour. Linn. Soc. Bot. 17: 477. 1879.

*Sabadilla dubia* Kuntze, Rev. Gen. Pl. 2: 713. 1891.

Bulb ovoid, small, 1.5–3 cm. in diameter; base of the plant covered for 4–13 cm. with scarious brown scales, separating above into fibers; leaves linear, narrow, suberect, 3–9 dm. long, 1–3 mm. broad;

scape very thin, 3–7 dm. high; spike slender, 10–35 cm. long, 5–8 mm. in diameter, virgate, flowers interruptedly and loosely arranged on the axis, pale green, very small, sessile; perianth-segments oblong, leathery, obscurely or not at all dentate, less than 2.5 mm. long; filaments filiform, very slender, twice the length of the perianth; capsule conic, ovate, nearly sessile, 8–10 mm. long, 5 mm. in diameter, appressed to the axis; seeds 5 mm. or less long, 2–5 in each cell.

Distribution: UNITED STATES.

FLORIDA—ALACHUA CO.: Gainesville, 3 May 1897, *Lighthipe* 479 (M, NY, US), March 1876, *Garber* (NY), June 1876, *Garber* (US), open pine land, 15 June 1910, *Hood* (M, 850094), 30 April 1936, and 10 July 1936, *Murrill* (M). BREVARD CO.: Indian River, 1897, *Crawford* (PA); Eau Gallie, dry pine barrens, July 1896, *Curtiss* 6551 (G, NY, M, US); Okeechobee Region, scrub-oak land, 10 July 1903, *Fredholm* 6032 (G, NY); Mosquito Lagoon, dry pine barrens, June 1879, *Curtiss* 2900 (G, M, NY, UC, US). HERNANDO CO.: Brooksville, moist woods, 26 April 1930, *Moldenke* 5943 (NY). LAKE CO.: Okahumpka, 3 March 1888, *Burk* (PA); Eustis, June and July 1894, *Hitchcock* (M 210134), June and July 1898, *Hitchcock* (M 210138), *Marsh* (M 760846), high pine land, 1–15 April 1898, *Nash* 297 (G, M, NY, UC, US), 16–31 July 1894, *Nash* 1447 (PA, US), and 19–30 June 1895, 2016 (NY, US). MARION CO.: east of Flemington, dry sandy woods, 29 April 1930, *Moldenke* 1087 (M, NY, US). ORANGE CO.: Lake Brantley, 12 July 1890, *Kline* (PA 517892); Aug. 1894, *Kline* (PA 517891); 7 July 1894, *Lewton* (NY), and 18 July 1894, (PA 517890); Aug. 1894, *ex Herb. Williamson* (PA 509795); Lake Conway, 11 April 1900, *Huger* 13 (M); dry pine barren, 12 July 1902, *Fredholm* 5387 (G, NY); Lake Helen, pine land, 24 April 1911, *Hood* (M 1073119). OSCEOLA CO.: Lake Gentry, 26 April 1925, *Howell* 1105 (US). PASCO CO.: St. Joseph, dry pine lands, 24 April 1927, *O'Neill* (M 953079). POLK CO.: vicinity of Winter Haven, high pine land east of Lake Marion, 12 May 1931, *McFarlin* 5261 (CA). VOLUSIA CO.: near Volusia, dry pine ridges, 24 March 1882, *Mohr* (US), dry sandy ridges, 4 April 1882, *Mohr* (US); Seville, dry pine barrens, 7 May 1900, *Curtiss* 6606 (G, M, NY, PA, UC, US); De Land, March 1891, *Hulst* (NY), 25 March 1891, *Hulst* [Hurst] (UC), 27 March 1891, *Hulst* (NY). FORT KING AND EASTERN FLORIDA: April and May, *Leavenworth* (NY). TAMPA BAY: *Leavenworth* (G); *Alden* (NY); 1834, *Burrows* (NY). LOCALITY INDEFINITE: 1839, Buckley (G, M, NY); *Chapman* (M 210141, US 968641); *Wright* (D 88718, NY).

**8. Schoenocaulon Ghiesbreghtii** Greenm. in Proc. Am. Acad. **43**: 20. 1907.

Bulb 1–1.5 cm. in diameter; basal portion of the plant covered with brownish-black scales and fibers to a height of 10–12 cm.; leaves narrow, 4–8 dm. long, 2–6 mm. broad; scape straight, 5–6.5 dm. long; spike 1–2.5 dm. long, 1.5–2 cm. in diameter; bract broadly ovate, 2.5 mm. long, obtuse, 5-nerved; flowers sessile or on short pedicels; segments of the perianth oblong, glandular, with two teeth on each margin, 4–4.5 mm. long, 1 mm. broad; filaments more than twice the length of the segments; fruit unknown.

MEXICO—CHIAPAS: *Ghiesbreght* 672 (G TYPE, M), and at alt. 2135 m., *Berendt* (G).

**9. *Schoenocaulon jaliscense* Greenm. in Proc. Amer. Acad. **43**: 20. 1907.**

Bulb oblong-ovoid, 2.5–3.5 cm. in diameter; basal portion of the plant covered with densely massed, tangled, fine, brownish fibers to a height of 14–16 cm.; leaves 6–10 dm. long, 2–7 mm. broad; scape 10–15 dm. long; spike 3–4 dm. long, 12 mm. in diameter; flowers small, shortly pedicelled, irregularly spaced on the axis; perianth-segments linear, with a single tooth on each margin; filaments reddish-purple, twice the length of the perianth; capsule ovate, 6 mm. long, 3 mm. in diameter, on curved pedicel and appressed to the axis.

MEXICO—JALISCO: near Guadalajara, cool grassy sides of canyons, *Pringle* 2938 (G TYPE); same locality, steep bluffs of ravines, *Pringle* 11853 (G, US).

**10. *Schoenocaulon macrocarpum* Brinker, n. sp.<sup>32</sup>**

Bulb ovoid, 2.5–3 cm. in diameter; base of the plant covered for 12–14 cm. with coarse black fibers; leaves about 5 dm. long, 2–3 mm. broad; scape 3–4.5 dm. long; spike 10–23 cm. long, about 8 mm. in diameter; flowers small, subsessile, erect, not very closely placed on the axis; perianth-segments ligulate, linear, with a single tooth on each margin; filaments reddish, twice the length of the perianth-segments; capsule linear-oblong, imbricated, appressed to the axis of the inflorescence, 16 mm. long, 4 mm. in diameter; 1–3 seeds in each cell.

MEXICO—NUEVO LEON: Sierra Madre Oriental, Canyon de los Charcos y Mesa de la Camisa, above Alamar, 15 mi. s.w. of Galeana, common in open wood in lower canyon, 4 June 1934, *Mueller* 724 (G TYPE, F).

**11. *Schoenocaulon megarhiza* Jones, Contr. West. Bot. **14**: 29. 1912 (as *megarrhiza*).**

Bulb 2.5–3.5 cm. in diameter; basal portion of the plant covered for 10–14 cm. with coarse, brownish-black fibers; leaves 3–7 dm. long, 3–6 mm. wide; scape 4–6 dm. long; spike 2–3 dm. long, 10–12 mm. in diameter; flowers small, sessile to subsessile; perianth-segments 3 mm. long, with a single tooth on each margin; filaments not much longer than the perianth; immature capsule 6 mm. long, 3 mm. in diameter, on a pedicel 3 mm. long; 3–4 seeds in each cell.

<sup>32</sup> *Schoenocaulon macrocarpum* sp. nov. Bulbus ovoideus, 2.5–3 cm. diametro; caule fibris crassis nigrisque ad 12–14 cm. obtecto; foliis circa 5 dm. longis, 2–3 mm. latis; scapo 3–4.5 dm. longo; spica 10–23 cm. longa, circa 8 mm. diametro; floribus parvis, subsessilibus, erectis, haud arcte dispositis; perianthii segmentis ligulatis, linearibus, utraque margine dente uno; filamentis rubris, perianthii segmentis duplo longioribus; capsulis linearis-oblongis, imbricatis, axi appressis, 16 mm. longis, 4 mm. diametro; seminibus in loculo 1–3.

MEXICO—CHIHUAHUA: Sierra Madre Mts., Guayanopa Canyon, alt. 1525 m., 23 Sept. 1903, *Jones* (P TYPE); transition pine slopes, Sierra Charuco, Rio Fuerte, infrequently scattered along shady banks and under trees, 23 July 1936, *Gentry* 2315 (G, M); transition, pine-oak country, solitary in shaded rock outcroppings, Sierra Canelo, Rio Mayo, 30 Aug. 1936, *Gentry* 2515 (G, M, UC); San Jose de Pinal, Rio Mayo, transition, pine slopes, in rocky terrain with harsh grass, 5 Sept. 1936, *Gentry* 2591 (M). SINALOA: Quebrado de Mansana, Sierra Surotato, open grassy slope, oak forest, alt. 1200–1350 m., 10–14 Sept. 1941, *Gentry* 6555 (M).

### 12. *Schoenocaulon Mortonii* Brinker, n. sp.<sup>33</sup>

Bulb unknown; leaves 6–7 dm. long, 3–5 mm. broad; scape erect, very long, 8.5–10 dm. long; spike many-flowered, 14–23 cm. long, 10–12 mm. in diameter; flowers sessile or on short pedicels, loosely disposed on the axis of the inflorescence; perianth-segments with a single wide tooth on each margin, 3 mm. long; filaments reddish-purple, twice as long as the perianth; capsule unknown.

MEXICO—MICHOACAN: Zitacuaro, Ypasote Hill, alt. 2175 m., steep rocky slope in sparse oak forest, 18 Nov. 1938, *Hinton* 13465 (M TYPE, G).

### 13. *Schoenocaulon obtusum* Brinker, n. sp.<sup>34</sup>

Bulb ovoid, 2–3 cm. in diameter; base of the plant sheathed for 10–20 cm. by a dense cylindrical growth of brown, coarse, rigid fibers; leaves about 5 dm. long, 3–8 mm. broad; scape 25–45 cm. long; spike dense, regular, 8–20 cm. long, 8–10 mm. in diameter; all the flowers maturing simultaneously and of the same disposition on the axis, touching each other, sessile; perianth-segments short, 3 mm. long, obtuse, with a single tooth on each margin; filaments scarcely longer than the perianth; capsules numerous, imbricated and appressed to the axis of the inflorescence, 8–10 mm. long, 5–7 mm. in diameter, 1–3 seeds in each cell.

MEXICO—HIDALGO: Sierra de Pachucha, Sept. 1903, *Rose & Painter* 6722 (G, US TYPE); El Chico, "Entre Roca Lumate," July 1929, *Lyonnnet* 329 (M, NY, US).

### 14. *Schoenocaulon officinale* (Schlecht. & Cham.) Gray in Hook. & Arn. Bot. Beechey's Voy. 388. 1840; Benth. Pl. Hartw. 29. 1840;

<sup>33</sup> *Schoenocaulon Mortonii* sp. nov. Bulbus ignotus; foliis 6–7 dm. longis, 3–5 mm. latis; scapo erecto, perlongo, 8.5–10 dm.; spica multiflora, 14–23 cm. longa, anthesi 10–12 mm. diametro; floribus sessilibus vel breviter pedicellatis, laxe dispositis; perianthii segmentis utraque margine dente lato uno, 3 mm. longis; filamentis rubro-purpureis perianthio duplo longioribus; capsulis ignotis.

<sup>34</sup> *Schoenocaulon obtusum* sp. nov. Bulbus ovoides, 2–3 cm. diametro; caudice cylindro ad 10–20 cm. fibris brunneis crassis rigidis dense obtecto; foliis circa 5 dm. longis, 3–8 mm. latis; scapo 25–45 cm. longo; spica densa, regularis, 8–20 cm. longa, 8–10 mm. diametro; floribus omnibus aequalibus maturitate et dispositione, mutuis tangentibus, sessilibus; perianthii segmentis brevibus, 3 mm. longis, obtusis, utraque margine dente uno; filamentis perianthio haud longioribus; capsulis numerosis, imbricatis et inflorescentiae axi appressis, 8–10 mm. longis, 5–7 mm. diametro; seminibus in loculo 1–3.

loc. cit. 96. 1842; Wats. in Proc. Am. Acad. **14**: 281. 1879; Baker in Jour. Linn. Soc. Bot. **17**: 476. 1879; Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 383. 1885, in part; Yuncker in Field Mus. Publ. Bot. **17**: 323. 1938.

*Veratrum officinale* Schlecht. & Cham. in Linnaea **6**: 45. 1831; Nees, Pl. Offic. *pl. 50*. 1821-33.

*Helonias officinalis* Don in Edinb. N. Phil. Jour. 234. 1832; Lindley, Fl. Med. 586. 1838.

*Sabadilla officinarum* Brandt (Brandt & Ratzeburg) in Hayne, Arzneig. **13**: *pl. 27*. 1836 [1837]; Schlecht. in Linnaea **18**: 444. 1844; Kuntze, Rev. Gen. Pl. **2**: 713. 1891, as *officinalis*; Standl. & Cald. in List. Prelim. Pl. El Salvador, 49. 1925, as *officinalis*; Knuth in Fedde Rep. Beih. **43**: 199. 1927, in part.

*Asagraea officinalis* Lindl. in Edwards' Bot. Reg. n.s. **2**: *pl. 33*. 1839; Hook & Arn. Bot. Beechey's Voy. 388. 1840; Kunth, Enum. Pl. **4**: 184, 1843; Spach in Hist. Nat. Veg. Phan. **12**: 245. 1846; Lindl. Med. & Oecon. Bot. 55, *fig. 90*. 1849; Hare, Caspari & Rusby, Nat. Stand. Dispens. 1336, *fig. 354*. 1905.

*Asagraea caracasana* Ernst in Jour. Bot. **9**: 91. 1871; Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 383. 1885, in synonymy

Bulb large and thick, 2.5-4 cm. in diameter; base of the plant covered for 8-20 cm. with dark brown scales separating above into fibers; leaves coarse, 3-10 dm. long, 3-15 mm. broad; scape angled below, terete above, 6-12 dm. long, 3-12 mm. in diameter; flowering spike dense, cylindrical, 1-5.5 dm. long, 12-18 mm. in diameter; perianth-segments ligulate, narrowly oblong lanceolate, 3-4 mm. long, margins entire, nectaries prominent at the base of the segment; filament thick, stout, 6-7 mm. long; fruiting spike 2 cm. in diameter; capsules numerous, crowded, elliptic-oblong, 10-13 mm. long, 4-5 mm. in diameter, on pedicels 4 mm. long; bracts deltoid, 3 mm. long; seeds 1-4 in each cell.

**Distribution:** Mexico, Central America to Venezuela and Peru.

#### NORTH AMERICA:

MEXICO—CHIAPAS: Fenia, open pine and oak forest, June 1925, *Purpus 405* (US); Siltepec, 9 Aug. 1937, *Matuda 1600* (F, NY). COLIMA: 9 Jan.-6 Feb. 1891, *Palmer 1410* (G, US). MEXICO STATE: Temascaltepec, Telpincla, alt. 1840 m., 17 Nov. 1932, *Hinton 2420* (CA); Temascaltepec, Chorrera, alt. 1230 m., 9 Oct. 1932, *Hinton 2039* (G, F). MICHOACAN: Zitacuaro, Piedra de Cal, alt. 1300 m., steep rocky slope, 10 Sept. 1938, *Hinton 13226* (G, M, NY, US). MORELOS: Hochicaleo, on sunny heights, 29 Sept. 1910, *Seler 5379 (296)* (G). GUERRERO: Mina, Santa Teresa, grassy hill, oak woods, alt. 1040 m., 12 Sept. 1936, *Hinton 9397* (US); Mina, Puerto del Clarin Cayunche, grassy hill, alt. 750 m., 21 Sept. 1936, *Hinton 9506* (US); Mina, Calavera, Puerto, oak woods, 19 Sept. 1936, *Hinton 9539* (G, NY, US). OAXACA: Santa Efigenia, alt. 150 m., 18 July 1895,

*Nelson* 2847 (US), and 2849 (F); San Benito, near Apango, alt. 500 m., 11 Oct. 1917, *Reko* 3475 (US). *VERA CRUZ*: Orizaba, June 1857, *Mohr & Botteri* (US), *Botteri* 1186 (G, US); Borrego, 1866, *Bourgeau* 2981 (G, US), 7 Oct. 1853, *Mueller* 222 (G, NY), Uluapam, Oct. 1853, *Mueller* 231 (NY), Consoquitla, 1841-43, *Liebmann* 14625 (F), Mirador, Oct. 1841, *Liebmann* 14627 (F), Aug. 1841, 14628 (G, F, UC, US), and 14629 (F); Maltrata, May 1937, *Matuda* 1346 (F, NY); Zaeapan, Fortin, sunny slopes, open woods, Aug. 1906, *Purpus* 2023 (F, G, M, NY, UC, US); Cerro de Borego, dry calcareous hills, collector unknown, 496 (PA). "On the eastern slopes of the Mexican Andes," in the Barranca de Tioselo near the Hacienda de la Laguna, *Schiede & Deppe* 982 (M TYPE).

A specimen in the Gray Herbarium labeled "Mexico (Hooker dupl. 1839)" without further data is referable to this species.

CENTRAL AMERICA:

**GUATEMALA**—DEPT. SANTA ROSA: Rio de Los Esclavos, alt. 750 m., Aug. 1892, *Heyde & Lux* (*Smith* 3874) (G, NY, US); Alameda, 8 Aug. 1937, *Johnston* 961 (F, NY). DEPT. HUEHUETENANGO: Uaxackanal, Quen Santo, open wooded limestone hills, 23 Aug. 1896, *Seler* 3220 (G); Chaguial, open wooded limestone hills, 7 Sept. 1896, *Seler* 3273 (G, US). DEPT. GUATEMALA: 10 km. s. of San Raimundo, damp wooded barranca, bushy slope, alt. 1800 m., 18 Jan. 1939, *Standley* 62922 (F); 1939, *Aguilar* 128 (F). DEPT. ZACAPA: lower slopes of Sierra de las Minas, along trail above Rio Hondo, 250-900 m. alt., grassy area, 11 Oct. 1939, *Steyermark* 29548 (F). DEPT. CHIQUIMULA: Montana Castilla, vicinity of Montana Cebollas, along Rio Lucia Saso, 3 mi. s.e. of Quezaltepeque, alt. 1200-1500 m., 6 Nov. 1939, *Steyermark* 31227 (F). DEPT. JUTIAPA: Lago Retana, between Overo and Progresso, alt. 600 m., 26 Nov. 1939, *Steyermark* 32025 (F). WITHOUT DEFINITE LOCALITY: in rocky places, 1840, *Hartweg* 627 (NY).

**HONDURAS**—DEPT. OF COMAYAGUA: 6 km. w. of Siguatepeque, moist soil, river bank, alt. 1250 m., 8 Aug. 1936, *Yuncker, Dawson & Youse* 6358 (F, G, M).

**EL SALVADOR**—Vicinity of San Salvador, *Renson* 167 (NY, US); Cerro de San Jacinto, Aug. 1922, *Calderon* 1060 (G, M, NY, US).

**COSTA RICA**—ALAJUELA: San Jose, Nuestro Amo, alt. 800 m., July 1912, *Jimenez* 637 (US).

SOUTH AMERICA:

**VENEZUELA**—CARACAS: Sept. 1929, *Elias* 71 (F); grassy hills, *Ernst* (US 601444); 24 June 1917, *Curran & Haman* 1196 (CA, F, G, NY, UC, US); mountain sides, alt. 600-1050 m., Dec. 1935, *Lawrance* 888 (NY); Middle Catouche wood, in forest, in savannas, alt. 1200-1400 m., 2 Sept. 1917, *Pittier* 7352 (G, US); La Guaira, old road, alt. 1100-1300 m., 6 June 1921, *Pittier* 9556 (G, US); 31 Oct. 1916, *Rose* 21887 (NY, US); Los Chorros, alt. 950 m., Dec. 1939, *Williams* 13604 (F); between Caracas and La Guaira, through Brett, *Rose* 21887 (US). TOVAR: 1854-5, *Fendler* 1506 (G, M). MIRANDA: hills above Los Teques, in open places, 7 Sept. 1924, *Pittier* 11611 (NY, US); Los Chorros, alt. 960 m., 20 Nov. 1939, *Williams* 12398 (F). LOCALITY UNSPECIFIED: 22 Sept. 1891, *Eggers* 13361 (F, US).

**PERU**—San Miguel, Urubama valley, alt. 1800 m., 31 May 1915, *Cook & Gilbert* 1013 (US); Santa Ana, alt. 900 m., 27 June 1915, *Cook & Gilbert* 1538 (US). CUZCO: POTRERO, Convencion, alt. 1300 m., 4 March 1940, *Vasgare* 1844 (G).

**15. Schoenocaulon Pringlei** Greenm. in Proc. Am. Acad. 32: 295. 1897.

Bulb ovoid, 1.5-3 cm. in diameter; base of the plant covered with coarse dark brown fibers to the height of 8-24 cm.; leaves narrow, 2.5-7 dm. long, 1-3 mm. broad; scape straight, 3-7.5 dm. long; flowering spike 2-10 cm. long, 8-10 mm. in diameter; fruiting spike

dense, 15 mm. in diameter; bract rounded at the apex; flowers closely appressed, sessile to subsessile; perianth-segments oblong-ovate, dark-brown, scarious-margined, 4–5 mm. long; filaments scarcely projecting beyond the perianth; capsules imbricated, oblong, 10–12 mm. long, 5 mm. in diameter; seeds small, thin, 4–5 mm. long, 1–5 in each cell.

MEXICO—HIDALGO: between Somoriel and Las Lajas, 5 Aug. 1905, *Rose, Painter & Rose* 9243 (G, US). FEDERAL DISTRICT: lava beds, Serrania de Ajusco, alt. 3050 m., 23 Aug. 1896, *Pringle* 6451 (CA, G, M, NY, PA, UC, US TYPE); Cima Station, lava fields, alt. 3050 m., 19 Sept. 1903, *Pringle* 11716 (G, US), alt. 2981 m., *Pringle* 13621 (G, US); La Cima de Ajusco, lava fields, alt. 2981 m., 2 Aug. 1906, *Pringle* 13778 (G, US). NAYARIT: near Santa Teresa, top of Sierra Madre, 13 Aug. 1897, *Rose* 2227 (US). PUEBLA: Mount Orizaba, 25–26 July 1901, *Rose & Hay* 5690 (US).

### 16. *Schoenocaulon regulare* Brinker, n. sp.<sup>35</sup>

Bulb ovoid, 2–4 cm. in diameter; base of the plant covered for 6–14 cm. by a collar of dark-brown, coarse fibers; leaves shorter than the scape and inflorescence, 2–6 dm. long, 2–5 mm. broad; scape 2.5–6 dm. long; spike loosely flowered, tapering, 10–24 cm. long, 7–10 mm. in diameter; flowers very small, sessile, equal to each other in size and maturity, regularly disposed; perianth-segments very small, with a single tooth on each margin, 2.5 mm. or less long; filaments twice the length of the perianth; capsules subsessile, 8–12 mm. long, 4–5 mm. in diameter; 2–4 seeds in each cell.

MEXICO—JALISCO: Sierra Madre Occidental, trail from San Sebastian to Real Alto, Loma del Oregano, alt. 1500 m., pine forest on steep hill-slope, 18 Feb. 1927, *Mexia* 1702 (CA, D, M, NY, UC, US TYPE); w. of San Sebastian, Hacienda del Otatal, Arroyo de los Hormos, alt. 1500 m., near stream, 6 March 1927, *Mexia* 1823a (CA, UC, US); Sierra Madre, w. of Polanos, 15–17 Sept. 1897, *Rose* 2987 (G, US). DURANGO: Santiago Papasquiaro, April–Aug. 1896, *Palmer* 419 (G, M, NY, UC, US).

### 17. *Schoenocaulon tenue* Brinker, n. sp.<sup>36</sup>

Bulb small, 1–1.5 cm. in diameter; base of the plant covered for

<sup>35</sup> *Schoenocaulon regulare* sp. nov. Bulbus ovoideus, 2–4 cm. diametro; caudice fibris atro-brunneis crassis ad 6–14 cm. dense obteeto; foliis scapo et inflorescentia brevioribus, 2–6 dm. longis, 2–5 mm. latis; scapo 2.5–6 dm. longo; spica laxiflora, attenuata, 10–24 cm. longa, 7–10 mm. diametro; floribus minimis, sessilibus, magnitudine et maturitate aequalibus, regulariter dispositis; perianthii segmentis minimis, utraque margine dente uno, 2.5 mm. vel minus longis; filamentis perianthio duplo longioribus; capsulis subsessilibus, 8–12 mm. longis, 4–5 mm. diametro; seminibus in loculo 2–4.

<sup>36</sup> *Schoenocaulon tenue* sp. nov. Bulbus parvus, 1–1.5 cm. diametro; caule fibris brunneis filamentosis ad 6–13 cm. alto obteeto; foliis tenuissimis, brevibus, subfiliformibus, 2.5–3.5 dm. longis, .5–2 mm. latis; scapo brevi, erecto, gracili, 16–35 cm. alto; spica 4–10 cm. longa, 10 mm. tantum diametro; floribus paucis, minimis, pedicellatis, distanter dispositis; perianthii segmentis utraque margine dente uno, ligulatis, 2.5–3 mm. longis; filamentis duplo perianthio longioribus; capsulis maturis parvis, 8–10 mm. longis, 4–5 mm. diametro; seminibus in loculo 1–2.

6–13 cm. with brown hair-like fibers; leaves very narrow, short, subfiliform, 2.5–3.5 dm. long, 0.5–2 mm. broad; scape short, erect, slender, 16–35 cm. high; spike 4–10 cm. long, only 10 mm. in diameter; flowers few, very small, pedicelled, distantly disposed on the axis of inflorescence; perianth-segments with a single tooth on each margin, ligulate, 2.5–3 mm. long; filaments twice as long as the perianth; mature capsules small, 8–10 mm. long, 4–5 mm. in diameter, 1–2 seeds in each cell.

MEXICO—MORELOS: cooler grassy slopes of the knobs of the Sierra de Tepoxtlan, alt. 2285 m., Sept.–Nov. 1900, Pringle 8356 (G, M TYPE, NY, P, PA, UC, US). SAN LUIS POTOSI: Charcas, July–Aug. 1934, Lundell 5464 (US).

Further collections of this plant may prove its identity with the obscure *S. Coulteri*.

**18. *Schoenocaulon tenuifolium* (Mart. & Gal.) Robins. & Greenm.** in Am. Jour. Sci. III, **50**: 168. 1895.

*Veratrum tenuifolium* Mart. & Gal. in Acad. Roy. Brux. Bul. **9<sup>2</sup>**: 380. 1842; Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 383. 1885.

*Asagraea tenuifolia* Kunth, Enum. Pl. **4**: 700. 1843; Hemsley, l.c.

Bulb 2.5–4.5 cm. in diameter; base of the plant covered with a sheath of very coarse fibers to the height of 15–30 cm.; leaves 5–9 dm. long, 3–10 mm. broad; scape stout, 10–36 cm. long; flowering spike 7–16 cm. long, 16–20 mm. in diameter at anthesis; subtending bract large, 4 mm. long; fruiting spike fertile at the base only, 4–5 cm. in diameter; flowers large, sessile, densely arranged on the axis; perianth-segments broadly ovate, green tipped with red, margin erose, 5 mm. long, 3 mm. broad; filaments thick, red, twice the length of the perianth; capsule large, inflated, obovate, 18–20 mm. long, 10–12 mm. in diameter; seeds large, oval, 7 mm. long, 5 mm. in diameter, 1–2 in each cell.

MEXICO—OAXACA: Cerro San Felipe, alt. 3000 m., Conzatti 688 (G); mountains s. of Miahuatlán, alt. 300 m., Nelson 2530a (G, US); Sierra de San Felipe, alt. 3011 m., Pringle 5857 (G, US), alt. 2890 m., 6653 (F, G, NY, M, PA, UC, US), and alt. 3200 m., 10184 (F, G, M, NY, PA, UC, US), alt. 300 m., Smith 753 (M, US).

**19. *Schoenocaulon texanum* Scheele in Linnaea **25**: 262. 1852.**

*Schoenocaulon Drummondii* Torrey in Bot. U.S. & Mex. Bound. Surv. **2**: 222. 1859, as to Pl. Lindh. only; Wats. in Proc. Am. Acad. **14**: 281. 1879, as to synonym; Baker in Jour. Linn. Soc. Bot. **17**: 477. 1879, as to synonym and *Lindheimer* 543 and 711; Wats. in Proc. Am. Acad. **18**: 166. 1883, as to *Coulter* 1570 only; Hemsl. in Salvin & Godman, Biol. Cent.-Am. Bot. **3**: 382. 1885; Small, Fl. South-

east. U.S. 250. 1903; Wooton & Standl. in Contr. U.S. Nat. Herb. 19: 129. 1915, as to synonym.

*Schoenocaulon intermedium* Baker in Jour. Linn. Soc. Bot. 17: 477. 1879, as to Coulter 1568 and 1570.

Bulb 1.5–2.5 cm. in diameter; basal portion of the plant covered with a dense cylinder of brownish-black fibers 7–15 cm. long; leaves narrow, recurved, 3–6 dm. long, 2–5 mm. broad; scape slender, 3–4.5 dm. long; spike pointed at the apex, densely flowered, 7.5–18 cm. long, 10–15 mm. in diameter; bracts acutish to acute, 2 mm. long; flowers erect, crowded, subsessile, pedicel less than 1 mm. long; perianth-segments linear-oblong, thickened, entire or obscurely dentate, 2 mm. long; filaments slender, slightly dilated toward the base only, 3–4 mm. long; capsules somewhat appressed to the axis of the inflorescence, 10–14 mm. long, 4–7 mm. in diameter; fruiting pedicel 2 mm. long; seeds 5–6 mm. long, 1–3 in each cell; flowering in spring.

Distribution: southwestern United States and northern Mexico.

UNITED STATES:

TEXAS—BEE CO.: Beeville, 30 March 1932, Jones 29080 (M, P, UC). BEXAR CO.: Leon Springs, tropical life zone, 17 May 1911, Clemens 483 (CA, M, P); nw. of San Antonio, hard limestone hillside along scenic loop, 26 April 1936, Metz 2436 (NY); San Antonio, April 1922, Schulz 792 (US). BREWSTER CO.: 5 mi. n. of Nichols' Ranch House, 4 April 1937, Warnock T625 (G). COMAL CO.: New Braunfels, stony prairies, dry places, April 1846, Lindheimer 543 (G, M, NY, PA, UC, US, all ISOTYPES), and April 1848, 711 (G, M, NY, PA); Comanche Spring, 1850, Lindheimer 1220 (M), and May 1851, 1221 (G, M, NY, PA, UC, US). CULBERSON CO.: ridge above McKittrick Canyon, shaded rocky places, 17 July 1931, Moore & Steyermark 3485 (CA, D, G, M, NY, PA, UC, US). GILLESPIE CO.: Nibo (?) Mt., Jermy 329 (M, US). GOLIAD CO.: Goliad, open prairie, March 1927, Williams 50 (PA). HAYS CO.: San Marcos, rocky uplands, 8 April 1918, Palmer 13309 (US); San Marcos and vicinity, spring 1898, Stanfield (NY). JEFF DAVIS CO.: 17 mi. sw. of Toyahvale, 30 Oct. 1935, Cory 17533 (G). KENDALL CO.: 8 3/4 mi. nw. of Boerne, 24 May 1935, Cory 13988 (G); rocky bluffs, June 1885, Reverchon 1607 (D, G, M, NY, P, US); Boerne, dry calcareous hills, 22 May 1916, Palmer 9841 (D, M, PA, US); on limestone hill, e. of Comfort, 29 April 1940, von Schrenk (M). KERR CO.: Turtle Creek, 2 May 1899, Bray 227 (US); about Kerrville, 480–600 m. alt., 12–19 June 1894, Heller 1626 (G, M, NY, PA, UC, US); Kerrville, sandy loam of stony hill, 9–10 May 1920, Pennell 10373 (NY, PA). TRAVIS CO.: Bull Creek, 2 May 1926, Bogusch 546 (US); Austin, 13 May 1872, Hall 644 (G, M, NY, P, US); near Austin, 24 April 1914, Young (M); Austin, 18 April 1903, ex Herb. Biltmore 14799 (US). Between Kerrville, KERR CO. and San Antonio, BEXAR CO.: 23 April 1931, Jones 78405 (M, P, UC). Between Mason, MASON CO. and Fredericksburg, GILLESPIE CO., 14 May 1932, McKelvey 2780 (G). WITHOUT DEFINITE LOCALITY: Guadalupe Mts., w. Texas, 1882, Havard 29 (G, PA); 1881, Havard (US). "Between w. Texas and El Paso, New Mexico," May–Oct. 1849, Wright 697 (G, UC, US). Upper Guadalupe, stony prairie, April 1845, Lindheimer 416 (G, M); mountainous prairies, May–June 1884, Reverchon 1607 (M).

NEW MEXICO—CHAVES CO.: 10 mi. w. of Roswell, 28 July 1905, Wooton (US). EDDY CO.: Guadalupe Mts., e. of Queen, crevices of rocks, 19 May 1932, Wilkins 2026 (PA, US).

MEXICO—CHIHUAHUA: Santa Eulalia Mts., May—June 1885, *Pringle 40* (G, NY, PA, US); same locality, 18 Aug. 1887, *Pringle 40* (M 207467), and coll. of 1885, *Wilkinson* (NY). HIDALGO: near Zimapan, *Coulter 1568* and *1570* (G). NUEVO LEON: Monterrey, Sierra Madre Mts., 27 July 1933, *Mueller 12* (G); foothills below Pablillo, 15 mi. sw. of Pueblo Galeana, alt. 2256—2440 m., rare in oak scrub, 21 May 1934, *Mueller 513* (G). PUEBLA: vicinity of Puebla, Hueyotlipan, alt. 2180 m., 15 June 1908, *Arsène 10227* (US); Manzanilla, 20 July 1910, *Nicolas 2302* (US); *Arsène* (US 1031247). TAMAULIPAS: vicinity of Marmolejo, Pico del Diabolo, 12 Aug. 1930, *Bartlett 10918* (US); 10 kilo. n.w. of El Progresso, which is 18 kilo. n.w. of Ocampo, on mountains with luxuriant vegetation, alt. 1450 m., 22 Aug. 1941, *Stanford, Rutherford & Northcraft 1055* (M).

## 20. *Schoenocaulon yucatanense* Brinker, n. sp.<sup>37</sup>

Bulb unknown; leaves 6 dm. and more long, 6—7 mm. broad; scape slender, 44 cm. long; spike 11 cm. long, 15 mm. in diameter at anthesis; all flowers sessile, erect; bracts small, scarious, very erose; perianth-segments erose-margined, ovate-oblong, about 2.5 mm. long; filaments three times as long as the perianth, slightly dilated above, reflexed, yellow; capsule unknown.

MEXICO—YUCATAN: Uxmal, on base of large pyramid, 20—21 July 1932, *Steere 2093* (NY TYPE).

<sup>37</sup> *Schoenocaulon yucatanense* sp. nov. Bulbus ignotus; foliis 6 dm. et ultra longis, 6—7 mm. latis; scapo gracili, 44 cm. longo; spica 11 cm. longa, anthesi 15 mm. diametro; floribus omnibus sessilibus, erectis; bracteis parvis, scariosis, valde erosis; perianthii segmentis margine erosis, ovato-oblongis, circa 2.5 mm. longis; filamentis perianthio triplo longioribus, superne sensim dilatatis, reflexis, luteis; capsulis ignotis.

## EXCLUDED SPECIES

*Asagaea frigida* (Schlecht. & Cham.) Lyons, Pl. Names Scientif. and Pop., ed. 508. 1907 = ***Stenanthium frigidum*** Kunth (*Veratrum frigidum* Schlecht. & Cham.), fide Index Kewensis.

*Asagaea longiflora* Rusby in Bull. N. Y. Bot. Gard. 6: 491. 1910 = ***Tofieldia falcata*** Pers. Syn. 1: 399. 1805.

## LIST OF EXSICCATAE

The numbers in the parentheses indicate the numbers of the species as treated in the monograph. The collector's numbers are in *italics*; the abbreviation *s.n.* signifies that the specimen is without a collector's number.

Aguilar, I. 128 (14).	Bourgeau, E. 2981 (14).
Alden, Lieut. <i>s.n.</i> (7).	Bray, W. L. 227 (19).
Arsène, Br. G. <i>s.n.</i> , 10227 (19).	Buckley, S. B. <i>s.n.</i> (7).
Bartlett, H. H. 10918 (19).	Burk, I. <i>s.n.</i> (7).
Berendt, <i>s.n.</i> (8).	Burrows, Dr., <i>s.n.</i> (7).
Biltmore (ex Herb.) 14799 (19).	Calderon, S. 1060 (14).
Bogusch, E. R. 546 (19).	Chapman, A. W. (ex Herb.) <i>s.n.</i> (7).
Botteri, M. 1186 (14).	Clemens, Mr. and Mrs. J. 483 (19).

- Conzatti, C. 688 (18).  
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Cory, V. L. 16146, 20644 (6); 13988, 17533 (19).  
Coulter, T. 1569 (5); 1568, 1570 (19).  
Crawford, J. *s.n.* (7).  
Curran, H. M. & Haman, M. 1196 (14).  
Curtiss, A. H. 2900, 6551, 6606 (7).  
Drummond, T. 284 (6).  
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Ehrenberg, K. *s.n.* (2).  
Elias, Br. 71 (14).  
Ernst, A. *s.n.* (14).  
Fendler, A. 1506 (14).  
Fredholm, A. 5387, 6032 (7).  
Garber, A. P. *s.n.* (7).  
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Ghiesbreght, A. 672 (8).  
Gregg, J. 214 (2).  
Groth, B. H. A. 202 (6).  
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Hartweg, T. 627 (14).  
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Metz, M. C. 2436 (19).  
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Mohr, C. A. & Botteri, M. *s.n.* (14).  
Moldenke, H. N. 1087, 5943 (7).  
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Rose, J. N. & Russell, P. G. 24160 (6).  
Schaffner, J. G. 228, 536 (3).  
Schiede, C. J. W. & Deppe, F. 982 (14).  
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Schrenk, H. von. *s.n.* (19).  
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- Stanfield, S. W. *s.n.* (19).  
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 Wilkins, H. *2026* (19).  
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 Wright, S. H. *s.n.* (7).  
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Accepted names are printed in Roman type; synonyms in *italics*; new names and new combinations, in **bold face** type.

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## EXPLANATION OF PLATE

## PLATE 27

Center: Generalized flower of *Schoenocaulon*,  $\times 4\frac{1}{2}$ .

Figs: A-G: Capsules.

Fig. A. *S. tenue*,  $\times 4$ .

Fig. B. *S. calcicola*,  $\times 5\frac{1}{2}$ , *S. regulare*,  $\times 5\frac{1}{2}$ , *S. officinale*,  $\times 5$ , *S. texanum*,  $\times 5$ .

Fig. C. *S. Pringeli*,  $\times 5$ .

Fig. D. *S. macrocarpum*,  $\times 4\frac{1}{2}$ .

Fig. E. *S. tenuifolium*,  $\times 4\frac{1}{2}$ .

Fig. F. *S. Conzattii*,  $\times 4$ , *S. dubium*,  $\times 4$ , *S. jaliscense*,  $\times 6$ , *S. megarhiza*,  $\times 6$ , *S. obtusum*,  $\times 4$ .

Fig. G. *S. caricifolium*,  $\times 4\frac{1}{2}$ , *S. comatum*,  $\times 6$ .

Figs. 1-13: Perianth-segments.

Fig. 1. *S. regulare*,  $\times 3$ .

Fig. 2. *S. Drummondii*,  $\times 4$ .

Fig. 3. *S. officinale*,  $\times 4$ .

Fig. 4. *S. yucatanense*,  $\times 4\frac{1}{2}$ .

Fig. 5. *S. Pringlei*,  $\times 4$ .

Fig. 6. *S. obtusum*,  $\times 4$ , *S. tenue*,  $\times 5$ .

Fig. 7. *S. Mortonii*,  $\times 4\frac{1}{2}$ .

Fig. 8. *S. dubium*,  $\times 4$ .

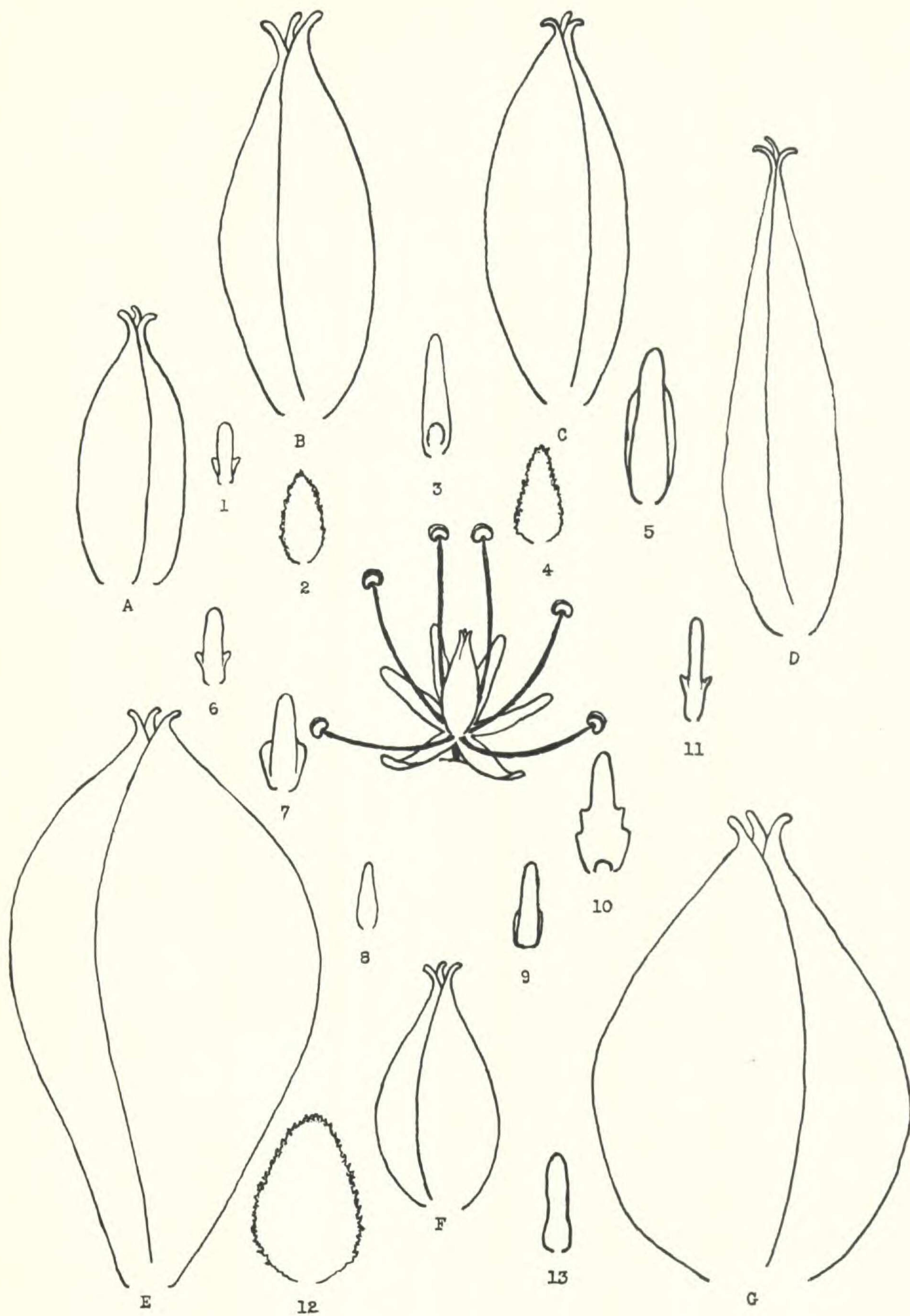
Fig. 9. *S. caricifolium*,  $\times 4$ .

Fig. 10. *S. Ghiesbreghtii*,  $\times 4$ .

Fig. 11. *S. macrocarpum*,  $\times 5$ ; *S. texanum*,  $\times 4$ ; *S. jaliscense*,  $\times 5$ ; *S. calcicola*,  $\times 4$ ; *S. Conzattii*,  $\times 3$ ; *S. megarhiza*,  $\times 6$ ; *S. Coulteri*,  $\times 4$ .

Fig. 12. *S. tenuifolium*,  $\times 4$ .

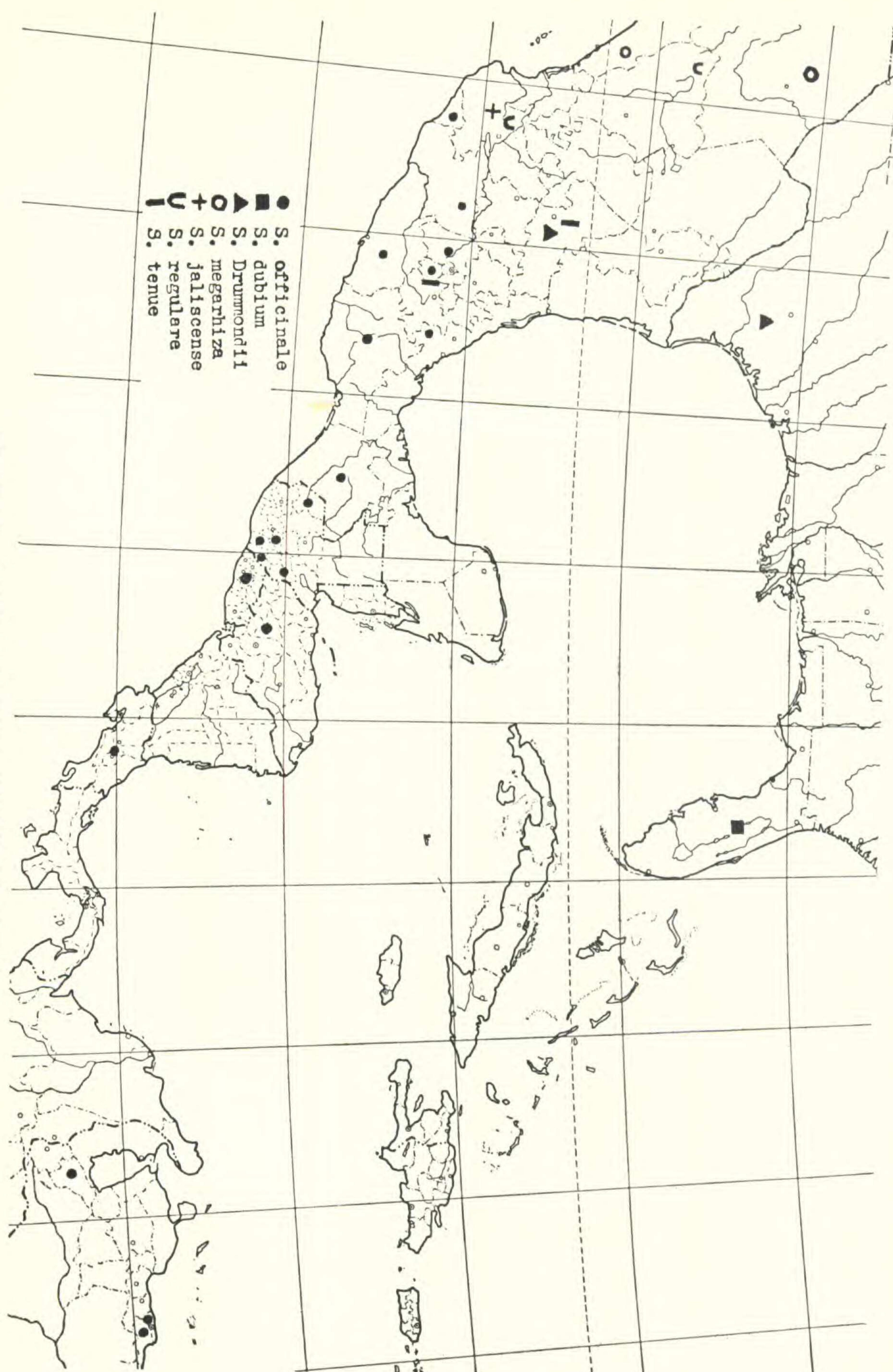
Fig. 13. *S. comatum*,  $\times 4$ .



## EXPLANATION OF PLATE

## PLATE 28

Map showing geographical distribution of species of *Schoenocaulon*.



## EXPLANATION OF PLATE

## PLATE 29

Maps showing geographical distribution of species of *Schoenocaulon*.

